The Excessive Burden of Low Socioeconomic Status Caregivers: Evidence from Stroke Survivors through CHARLS Data (2011-2018)

EE60

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Introduction

According to the World Stroke Organization, stroke is the second leading cause of death and the third leading cause of disability worldwide; furthermore, around 26% of stroke survivors after the surgical intervention require long-term care after 6 months in the United States, and the number goes to 19% in 5 years for the British population (Burton *et al.*, 2018).

Since the Asian population shares a similar risk ratio as White groups (Khan *et al.*, 2013), incumbent data such as CHARLS (China Health and Retirement Longitudinal Study) collected through surveys designed by the University of Southern California (USC) under National Institute of Aging R01 serves a clear-cut purpose to demonstrate the stroke survivors' caregivers wellbeing status through time.

Objectives

This research project answers the following questions in condition to married stroke survivors whose spouses are also caregivers:

(1) How did the caregiver's mental health change since the first stroke event?

(2) How long did the caregiver recover from event-based economic shocks?

(3) Were the answers different after controlling socioeconomic status (SES)?

The overall goal is to show the necessity of universal coverage of **caregivers** when facing acute diseases with potentially long-lasting effects.

Dataset and Criteria

Dataset: Harmonized CHARLS Data (2011-2018)

Sampled Population: 25,586 individuals aged 45+ (11,988 constant replies)
Gaps between 4 waves are set with a 2-year increment

Inclusion Criteria:

(1) "r (respondent) ever had a stroke" or
"s (spouse of respondent) ever had a stroke"

(2) Unchanged marital status over the 4 waves (fixed r-s pairings)

(3) Complete answers for clear socioeconomic status (SES) identifiers

Exclusion Criteria:

(1) Formal care is provided (*e.g.*, Nursing Facilities) $\rightarrow$ N = 16

(2) Both r and s had stroke events between Waves 2–4 $\rightarrow$ N = 85

$\Rightarrow$ 1,693 individuals included for the following analyses

Models Applied:

(1) OLS for income difference estimation since the first-ever stroke event

(2) Ordered Probit for mental status difference estimation based on CES-D-10

Results

Variables	Observations	Count	Proportion
Low SES	1,693	732	43.21%
Education Level: Below Lower-secondary	1,533	1,008	65.75%
Education Level: Below Elementary	1,533	652	42.53%
Hukou (Residency): Rural	1,693	1,378	81.39%
Gender: Female	1,693	439	54.47%
Not Retired $\rightarrow$ Not Retired	1,403	1,146	81.68%
Not Retired $\rightarrow$ Retired	1,403	31	2.21%
Retired $\rightarrow$ Retired	1,403	226	16.11%
CES-D-10$_{t-1} \in [0,5)$: Not Depressed	1,398	465	33.26%
CES-D-10$_{t-1} \in [5,10)$: Moderately Depressed	1,398	400	28.61%
CES-D-10$_{t-1} \in [10,30]$: Depressed	1,398	533	38.13%
CES-D-10$_{t} \in [0,5)$: Not Depressed	1,364	388	28.45%
CES-D-10$_{t} \in [5,10)$: Moderately Depressed	1,364	417	30.57%
CES-D-10$_{t} \in [10,30]$: Depressed	1,364	559	40.98%
CES-D-10$_{t+1} \in [0,5)$: Not Depressed	279	72	25.81%
CES-D-10$_{t+1} \in [5,10)$: Moderately Depressed	279	85	30.47%
CES-D-10$_{t+1} \in [10,30]$: Depressed	279	122	43.73%

Variables	Observations	Mean	Std. Dev.
Income Difference$_t$	1,207	1,923.676	10,001.38
Income Difference$_{t+1}$	248	2,078.637	12,398.55
Income$_{t-1}$	1,315	5,655.115	10,718.60
Income$_t$	1,367	7,758.64	13,728.36
Income$_{t+1}$	291	7,219.676	13,789.50
Hour Difference$_t$	655	-3.47	31.89
Hour Difference$_{t+1}$	126	-8.40	24.53
Working Hours$_{t-1}$	859	44.01	26.06
Working Hours$_t$	828	41.11	29.92
Working Hours$_{t+1}$	170	37.84	27.73
CES-D-10$_{t-1}$	1,398	8.73	6.72
CES-D-10$_t$	1,364	9.26	6.80
CES-D-10$_{t+1}$	279	9.97	7.02
Age (by Wave 4)	1,444	64.09	8.61

Model 1. OLS for Income Differences

$$y_i = \mathbf{X}_i'\beta + \gamma \cdot Low.SES_i + \epsilon_i \quad (1)$$

t: The time period when the first stroke event occurred

y: (1)-(3) [Total Income of Wave t] $-$ [Total Income of Wave $t-1$];
(4)-(5) [Total Income of Wave $t+1$] $-$ [Total Income of Wave t] when applicable

X: (1) Gender as Female, Age, Rural Residency
(2) Model (1) controlling retirement status & work hours changed from $t-1$ to t
(3) Model (2) controlling CES-D-10 levels on Wave t
(4) Model (3) changing CES-D-10 levels to Wave $t+1$ and work hours as t to $t+1$
(5) Model (4) adding the previous income change (autoregressive)

VARIABLES	(1) $\triangle$ Income$_t$	(2) $\triangle$ Income$_t$	(3) $\triangle$ Income$_t$	(4) $\triangle$ Income$_{t+1}$	(5) $\triangle$ Income$_{t+1}$
Low SES	-6,340***	-5,351***	-5,210***	5,988***	3,365**
	(603.7)	(745.7)	(753.0)	(1,898)	(1,553)
Gender: Female	-1,457**	-887.3	-1,016	2,870	956.8
	(654.8)	(928.0)	(941.9)	(1,925)	(1,442)
Age	139.8***	103.7*	110.1**	-3.545	44.38
	(46.23)	(53.31)	(53.24)	(105.7)	(106.0)
Rural Residency	1,479	-2,351	-2,578	-9,730	-6,188
	(1,249)	(5,478)	(5,565)	(6,067)	(5,024)
$\triangle$ Working Hours$_t$		33.35***	34.22***		
		(9.712)	(9.873)		
$\triangle$ Working Hours$_{t+1}$				91.76***	65.10**
				(32.46)	(25.38)
Not Retired $\rightarrow$ Retired		3,111	2,900	-5,064**	-2,611
		(4,771)	(4,816)	(2,427)	(1,795)
Retired $\rightarrow$ Retired		7,511**	6,603*	-2,909	-1,752
		(3,365)	(3,687)	(10,229)	(9,383)
CES-D-10$_t$: Moderately Depressed			-738.9		
			(1,060)		
CES-D-10$_t$: Depressed			-1,062		
			(856.4)		
CES-D-10$_{t+1}$: Moderately Depressed				-4,203**	-115.4
				(1,875)	(1,634)
CES-D-10$_{t+1}$: Depressed				2,190	2,781
				(1,790)	(1,698)
$\triangle$ Income$_t$					-0.462***
					(0.130)
Constant	-4,151	799.8	1,266	6,026	822.5
	(3,283)	(7,091)	(7,211)	(7,338)	(6,811)
Observations	1,203	580	576	117	113
R-squared	0.085	0.153	0.145	0.196	0.338

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Model 2. Ordered Probit Model for Mental Status

$$y_i^\star = \mathbf{X}_i'\beta + \gamma \cdot Low.SES_i + \epsilon_i, \quad \epsilon_i \sim N(0,1), \quad \forall i = 1,\ldots,N \quad (1)$$

$$\begin{cases} y_i = 0 \text{ (Not Depressed)} & \text{if } y_i^\star \le \alpha_1 \\ y_i = 1 \text{ (Moderately Depressed)} & \text{if } \alpha_1 < y_i^\star \le \alpha_2 \\ y_i = 2 \text{ (Depressed)} & \text{if } \alpha_2 < y_i^\star \end{cases} \quad (2)$$

$$\begin{cases} P(y_i = 0|\mathbf{X}) = P(y_i^\star \le \alpha_1) & = \Phi(\alpha_1 - \mathbf{X_i}'\beta) \\ P(y_i = 1|\mathbf{X}) = P(\alpha_1 < y_i^\star \le \alpha_2) & = \Phi(\alpha_2 - \mathbf{X_i}'\beta) - \Phi(\alpha_1 - \mathbf{X_i}'\beta) \\ P(y_i = 2|\mathbf{X}) = P(\alpha_2 < y_i^\star) & = 1 - \Phi(\alpha_2 - \mathbf{X_i}'\beta) \end{cases} \quad (3)$$

t: The time period when the first stroke event occurred

y: CES-D-10 Level of (1)-(3) Wave t; (4)-(5) Wave $t+1$ when applicable

X: (1) Gender as Female, Age, Rural Residency
(2) Model (1) controlling retirement status & work hours changed from $t-1$ to t
(3) Model (2) controlling CES-D-10 levels on Wave $t-1$
(4) Model (3) changing CES-D-10 levels to Wave t and work hours as t to $t+1$
(5) Model (4) adding the previous CES-D-10 levels on Wave $t-1$

VARIABLES	(1) CES-D-10$_t^\star$	(2) CES-D-10$_t^\star$	(3) CES-D-10$_t^\star$	(4) CES-D-10$_{t+1}^\star$	(5) CES-D-10$_{t+1}^\star$
Low SES	0.158**	0.191*	0.194*	-0.203	-0.101
	(0.0702)	(0.106)	(0.108)	(0.227)	(0.245)
Gender: Female	-0.316***	-0.506***	-0.351***	-0.651***	-0.754***
	(0.0662)	(0.0970)	(0.102)	(0.238)	(0.251)
Age	-0.000891	-0.0112	-0.00884	-0.0227	-0.0222
	(0.00394)	(0.00692)	(0.00689)	(0.0154)	(0.0148)
Rural Residency	0.447***	0.983***	0.590**	-0.0495	-0.160
	(0.0879)	(0.268)	(0.272)	(0.785)	(0.786)
$\triangle$ Working Hours$_t$		0.00317**	0.00229		
		(0.00146)	(0.00149)		
$\triangle$ Working Hours$_{t+1}$				-0.0145***	-0.0158***
				(0.00514)	(0.00524)
Not Retired $\rightarrow$ Retired		-0.0118	-0.354	5.063***	5.099***
		(0.427)	(0.344)	(0.315)	(0.366)
Retired $\rightarrow$ Retired		0.281	0.307	-5.610***	-5.720***
		(0.262)	(0.267)	(0.832)	(0.847)
CES-D-10$_{t-1}$: Moderately Depressed			0.428***		-0.361
			(0.118)		(0.286)
CES-D-10$_{t-1}$: Depressed			1.108***		0.0942
			(0.117)		(0.596)
CES-D-10$_t$: Moderately Depressed				0.535*	0.878***
				(0.304)	(0.304)
CES-D-10$_t$: Depressed				1.564***	1.555***
				(0.325)	(0.524)
/cut1 (α_1)	-0.339	-0.600	-0.259	-1.787	-1.866
	(0.254)	(0.445)	(0.452)	(1.236)	(1.275)
/cut2 (α_2)	0.486*	0.294	0.729	-0.735	-0.671
	(0.254)	(0.443)	(0.450)	(1.244)	(1.271)
Observations	1,360	639	627	119	111

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Conclusion

Setting "Low-SES" standards as below low-secondary education & $1,657 by 2020 CPI; our primary findings for first-time stroke caregivers (spouses) are:

(1) Mental stress lasts after the event, worse with additional economic burden

(2) Economic recovery for low-SES families after the event lasts for 4+ years

(3) High-SES families faced less economic shocks but similar mental stress

Future topics to be discussed:

With the harsher economic conditions since COVID-19, are the rural low-SES families still recovering in 4 years? How can we ease the mental stress and economic loss of caregivers after acute events?

Necessity of global coverage — We need caregiver insurance